

REMARKS

Applicant acknowledges with appreciation the Examiner's apparent careful review of the specification, drawing and claims. Claims 1, 6, 8, 15, 26, 32, 38-46, 48-52, and 85-90 are amended. Claims 35, 36, 47, and 53-84 are cancelled, without prejudice to their underlying subject matter. Claims 11, 12, 23, 30, 44, and 90-93 have been withdrawn from consideration by the Examiner as allegedly directed to a non-elected species. Claims 1-35, 37-52, and 85-93 are pending.

The drawings stand objected to under 37 C.F.R. § 1.83(a) as not showing every feature of the invention claimed, specifically the "single active area extension region and said halo implant region spaced away from a gate of said first transistor by a portion of a substrate supporting said first transistor (claim 8) while the halo implant region extends partially below the gate (claim 6)" (Office Action at 2). In view of the amendment to claim 8, this objection is respectfully requested to be withdrawn.

Claims 22, 26, and 49 stand objected to because of informalities. Applicant respectfully traverses the objection. In view of the explanation below and the amendment to the claims, the objection should be withdrawn.

Claim 22 depends from claim 21 and is objected to because the recited "threshold voltage adjustment implant" is alleged to be the same as the "halo implant region." This is not so. As is shown by FIGs. 4(a) to 6(b) and discussed in the related parts of the specification (e.g., paragraphs 0041-0046), different dopant implant steps are used to dope the substrate in different locations at different stages of processing. FIG. 4(a), for example, shows that implant 121 is used for a threshold voltage (V_t) adjustment implant (specification paragraph 0042), which implants dopant in accordance with the techniques of U.S. patent application 09/945,252 (now U.S. Patent

6,630,706) under the gate electrode of the transfer transistor (i.e., feature 15). As shown by FIG. 6(a), for example, a four-way angled halo implant 51 is performed after the V_t implant and the active area extension region implant 50 so as to form region 41 predominantly (but not exclusively) in the area between the transfer transistor gate and the reset transistor gate (specification paragraph 0045). Since the Application makes clear that these two implants are not the same, the objection to different claims reciting these different implants should be withdrawn. Also, this distinction between implant types must be taken into consideration in view of the following remarks.

Claims 1-3, 7, 9, 14, 32-34, 37, 38, 41, 45, 50, 85, 86, and 89 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,166,405 ("Kuriyama et al."). Also, claims 4, 6, 8, 21, 22, 24-30, 35, 39, 43, 51, and 88 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuriyama et al. in view of U.S. Patent 5,780,902 ("Komuro"). Applicant respectfully traverses these rejections and they are dealt with together in view of the amendment to the claims.

Claim 1, as amended, defines a CMOS imager and recites "a photoconversion device" and "a first transistor having a gate with a first side and a second side opposite said first side, said gate being associated with said photoconversion device at said first side of said gate, said first transistor also having a single active area extension region associated with said second side of said gate and a halo implant region below said single active area extension region." This claimed subject matter is not anticipated by Kuriyama et al. individually, as acknowledged in the Office Action at pages 9 and 10.

The Office Action states, "the difference between Kuriyama [et al.] and the claimed invention is the channel region of said first transistor has a threshold voltage adjustment implant (halo implant region) extending partially below a gate of said first transistor" (Office Action at 9-10). The Office Action accurately notes that Kuriyama et

al. has no halo implant and has no threshold voltage implant; however, the Office Action's statement that the halo implant region and threshold implant are the same is incorrect. The threshold voltage implant and halo implant region, which is recited by the claim, are not the same feature, as discussed above in relation to the objection to the claims. In any event, it is clear from a reading of the Kuriyama et al. reference that it fails to teach or suggest either feature. For this reason, and because the subject matter of claim 6 directed to the "halo implant region" has been incorporated into claim 1, the rejection of the claims under 35 U.S.C. § 103 over Kuriyama et al. in view of U.S. Patent 5,780,902 ("Komuro") is addressed here.

Additionally, as of the filing date, there would have been no motivation to combine the cited references. The Kuriyama et al. disclosure is directed to an imaging device. Komuro, on the other hand, is directed only to a semiconductor device, i.e., a transistor having a source/drain on either side, the drain of which including an LDD structure and a doped pocket region under the LDD. There is nothing in either reference to suggest the desirability or utility of utilizing the structure disclosed in Komuro with a photosensor structure like that disclosed by Kuriyama et al. Also, the dopant pocket (i.e., 14) of Komuro is disclosed as useful for the suppression of short channel effects and hot carrier generation, neither of which is suggested to be a problem in need of solution by Kuriyama et al. Additionally, the pocket doped region of Komuro is not a halo implant, as recited by the claims. It is a localized region of dopant formed by a single-angled implantation (col. 4, ll. 1-7; col. 5, ll. 23-26) into a very specific pocket; not a halo region, which is typically formed by a multi-angled, or at least multi-regional, implant (see, e.g., Application paragraph 0045).

The mere fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness, the prior art must also suggest the desirability of the

combination. M.P.E.P. § 2143.01 (citing In re Mills, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990) (emphasis added). A statement that modifying or combining the prior art to meet the claimed invention would have been obvious to the ordinary artisan at the time the invention was made (see, e.g., Office Action, page 10) because the references teach that all aspects of the claimed invention were individually known is insufficient for an obviousness rejection without an objective reason to combine the references, other than reasoning provided only by the subject application. Id. (citing Ex parte Levingood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). There is no motivation evidenced in the cited references themselves for selectively combining their teachings in the manner expressed in the Office Action, nor would there have been any practical reason to deviate from the disclosure of the primary reference; i.e., “no objective reason.”

“It is difficult but necessary that the [examiner] forget what he or she has been taught . . . about the claimed invention and cast the mind back to the time the invention was made.” M.P.E.P. § 2141.01(III) (citing W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). Without reliance on *improper hindsight* based on use of the present application as a road map, here the references’ disclosures would not have been combined; the primary reference presents no reason to do so. A person of ordinary skill in the art would not have been motivated to combine these references to produce the claimed invention because each reference addresses a different technology, suggests different problems and provides different advantages.

Further, “[t]he showing of motivation to combine must be clear and particular, and it must be supported by actual evidence.” Teleflex, Inc. v. Ficosa North America Corp., 299 F.3d 1313, 1334 (Fed. Cir. 2002), citing In re Dembiczak, 175 F.3d

994, 999 (Fed. Cir. 1999). “Broad, conclusory statements regarding the teaching of the multiple references, standing alone, are not ‘evidence.’” In re Dembicza, 175 F.3d at 999. There is no such clear and particular evidence provided in the Office Action for the combination of references.

It is acknowledged in the Office Action that Kuriyama et al. fails to anticipate claim 1, as amended. Also, neither Kuriyama et al. nor Komuro individually teaches or suggests the claimed subject matter. Further, because of the lack of motivation to combine Kuriyama et al. and Komuro, the subject matter of the claims would not have been obvious over these references, which individually do not teach or suggest such subject matter. Applicants respectfully request that the 35 U.S.C. §§ 102(b) and 103(a) rejection of claims 1-4, 6-9, and 14 be withdrawn.

Claim 21 defines a pixel sensor cell and recites “a semiconductor substrate” and “a reset transistor over said substrate” and “a photosensor in electrical communication with said reset transistor, said photosensor being within said substrate on a first side of said reset transistor” and “a single active area extension region in said substrate adjacent to said reset transistor, said single active area extension region being on a side of said reset transistor which is opposite to said first side” and “a halo implant region in said substrate below said single active area extension region.” Such a device is not taught or suggested by Kuriyama et al. individually or combined with Komuro.

Claim 21 recites similar subject matter to claim 1. In particular, claim 21 recites “a halo implant region in said substrate below said active area extension region.” As discussed above in relation to the patentability of claim 1, this is not taught or suggested by either Kuriyama et al. or Komuro alone, and further, there is no motivation to combine the Komuro reference with Kuriyama et al. Therefore, for at least the same reasoning as set forth above for claim 1, independent claim 21 is

patentable over Kuriyama et al. and Komuro. Applicant respectfully requests that the 35 U.S.C. §§ 102(b) and 103(a) rejections of claims 21, 22, 24, and 25 be withdrawn.

Claim 26 defines an image sensor and recites “a semiconductor substrate” and “a reset transistor over said substrate” and “a floating diffusion region in said substrate and in electrical communication with said reset transistor at a first side of said reset transistor” and “a single active area extension region in said substrate adjacent to said reset transistor, said single active area extension region being on a second side of said reset transistor which is opposite to said first side” and “a halo implant region in said substrate below said single active area extension region.” Such a device is not taught or suggested by Kuriyama et al. individually or combined with Komuro.

Claim 26 recites similar subject matter to claims 1 and 21. In particular, claim 26 recites “a halo implant region in said substrate below said active area extension region.” As discussed above in relation to the patentability of claims 1 and 21, this is not taught or suggested by Kuriyama et al. or Komuro alone, and further, there is no motivation to combine the Komuro reference with Kuriyama et al. Therefore, for at least the same reasoning as set forth above for claim 1, independent claim 26 is patentable over Kuriyama et al. and Komuro. Applicant respectfully requests that the 35 U.S.C. §§ 102(b) and 103(a) rejections of claims 26-30 be withdrawn.

Claim 32, as amended, defines an imager device, comprising an image processor and a pixel array, and recites “a photoconversion device” and “a first transistor gate associated with said photoconversion device at a first side of said transistor gate, said transistor gate having a single lightly doped drain on a second side of said transistor gate opposite said first side, an underlying channel region having a threshold voltage adjustment implant, a halo implant below said lightly doped drain, and said gate also having a length which is increased relative to other transistor gates of

“said pixel.” Such a device is not anticipated, taught or suggested by Kuriyama et al. and Komuro, taken individually or combined.

Claim 32, like claim 1, recites a “halo implant” in combination with other imager device features, and therefore patentable over the cited references for at least the same reasoning as set forth above for claim 1. Further, no combination of references cited in the office action teaches or suggests the transistor gate having each of “a single lightly doped drain” and “a threshold voltage adjustment implant” and “a halo implant” and “a gate . . . length which is increased.” For this reason also, claim 32 is patentable over all cited references. Applicants respectfully request that the 35 U.S.C. §§ 102(b) and 103(a) rejections of claims 32-37 be withdrawn.

Claim 38, as amended, defines an integrated circuit comprising a transistor in electrical contact with a photodiode and recites “said transistor comprising a single active area extension region on a side of said transistor opposite from said photodiode and a halo implant below said single active area extension region.” Such a device is not anticipated, taught or suggested by Kuriyama et al. and Komuro, taken individually or combined. Like claim 1, this claim recites a “halo implant,” and therefore patentable over the references for at least the same reasoning as set forth above for claim 1. Applicant respectfully requests that the 35 U.S.C. §§ 102(b) and 103(a) of claims 38, 39, 41-43, and 45 be withdrawn.

Claim 50, as amended, defines an integrated circuit comprising a transistor in electrical contact with a photodiode and recites “said transistor comprising a single active area extension region on a opposite side of said transistor from said photodiode and a halo implant and a source/drain region adjacent said active area extension region, said active area extension region, said halo implant, and said source/drain region being spaced away from a gate of said transistor.” Such a device is not anticipated, taught or

suggested by Kuriyama et al. and Komuro, taken individually or combined. Like claim 1, this claim recites a “halo implant,” and therefore patentable over the references for at least the same reasoning as set forth above for claim 1. Applicant respectfully requests that the 35 U.S.C. §§ 102(b) and 103(a) of claims 50 and 51 be withdrawn.

Claim 85, as amended, defines an integrated circuit comprising a transistor and recites “a channel region between a higher voltage side and a lower voltage side, and a single active area extension region with a halo implant at said higher voltage side of said channel.” Such a device is not anticipated, taught or suggested by Kuriyama et al. and Komuro, taken individually or combined. Like claim 1, this claim recites a “halo implant,” and therefore patentable over the references for at least the same reasoning as set forth above for claim 1. Applicant respectfully requests that the 35 U.S.C. §§ 102(b) and 103(a) of claims 85, 86, 88, and 89 be withdrawn.

Claims 1, 5, 38, 40, 46, 47, 85, and 87 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,730,899 (“Stevens et al.”). Applicant respectfully traverses this rejection.

Claim 1 defines a CMOS imager and recites features as discussed above. Stevens et al. fails to anticipate the claim. Stevens et al. does not disclose an active area extension region, as recited by the claim. The active area (80) disclosed by Stevens et al. has no extension. For at least this reason, the claim is patentable over the reference. Further, Stevens et al. fails to disclose the “halo implant region” recited by the claim and for this reason as well, the claim is patentable over the reference. Applicant respectfully requests that the 35 U.S.C. § 102(e) rejection of claims 1 and 5 be withdrawn.

Claim 38 defines an integrated circuit comprising a transistor in electrical contact with a photodiode, as discussed above. Stevens fails to anticipate the claim. As discussed above in relation to the patentability of claim 1, Stevens et al. fails to disclose an active area extension region, as recited by the claim. For at least this reason, the claim is patentable over the reference. Further, Stevens et al. fails to disclose the "halo implant" recited by the claim and for this reason as well, the claim is patentable over the reference. Applicant respectfully requests that the 35 U.S.C. § 102(e) rejection of claims 38 and 40 be withdrawn.

Claim 46, as amended, defines a pixel cell comprising a transistor in electrical contact with a photodiode and recites "said transistor comprising a single active area extension region and halo implant region on a opposite side of said transistor from said photodiode, said transistor also having a gate length which is increased relative to any other transistor gate length of transistors of said pixel cell." As discussed above in relation to the patentability of claim 1, Stevens et al. fails to disclose an active area extension region, as recited by the claim. For at least this reason, the claim is patentable over the reference. Further, Stevens et al. fails to disclose the "halo implant region" recited by the claim and for this reason as well, the claim is patentable over the reference. Applicant respectfully requests that the 35 U.S.C. § 102(e) rejection of claim 46 be withdrawn.

Claim 85 defines an integrated circuit comprising a transistor, as discussed above. Stevens fails to anticipate the claim. As discussed above in relation to the patentability of claim 1, Stevens et al. fails to disclose an active area extension region, as recited by the claim. For at least this reason, the claim is patentable over the reference. Further, Stevens et al. fails to disclose the "halo implant" recited by the claim and for

this reason as well, the claim is patentable over the reference. Applicant respectfully requests that the 35 U.S.C. § 102(e) rejection of claims 85 and 87 be withdrawn.

Claims 10 and 13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuriyama et al. Applicant respectfully traverses this rejection. Claims 10 and 13 depend from independent claim 1 and are patentable over Kuriyama et al. for at least the same reasoning as set forth above in relation to the patentability of claim 1 over the reference. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 10 and 13 be withdrawn.

Claims 15 and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuriyama et al. in view of U.S. Patent 6,794,215 ("Park et al."). Applicant respectfully traverses this rejection.

Claim 15, as amended, defines a pixel sensor cell and recites "a semiconductor substrate" and "a transfer transistor over said substrate, said transfer transistor having a single active area extension region located on a first side of said transfer transistor" and "a photosensor in electrical communication with said transfer transistor, said photosensor being within said substrate on a second side of said transfer transistor which is opposite to said first side" and "a reset transistor gate over said substrate and spaced apart from said transfer transistor" and "a floating diffusion region on the first side of said transfer transistor and adjacent said reset transistor gate, said floating diffusion region being in electrical communication with said active area extension region and having a halo implant region." As acknowledged in the Office Action (pages 9-10), Kuriyama et al. fails to disclose at least the halo implant region recited by claim 15. Park et al. likewise does not disclose such a feature. For at least this reason, the claimed subject matter is patentable over the references and Applicant

respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 15 and 20 be withdrawn.

Claims 16, 18, and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kuriyama et al. in view of Park et al. and further in view of Komuro. Applicant respectfully traverses this rejection.

Claims 16, 18, and 19 depend from independent claim 15, which has been discussed above as being patentable over Kuriyama et al. and Park et al. As discussed above, there is no motivation to combine the disclosure of Komuro with Kuriyama et al. Park et al. does not provide such motivation. Therefore, for at least the same reasoning set forth above in relation to the patentability of claim 1 over Kuriyama et al. and Komuro and of claim 15 over Kuriyama et al. and Park et al., claims 16, 18, and 19 are likewise patentable over the references. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 16, 18, and 19 be withdrawn.

Claims 15, 17, 32, 36, 47, 49, 50, and 52 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Stevens et al. in view of Kuriyama et al. Applicant respectfully traverses this rejection.

Claim 15 defines a pixel sensor cell, as discussed above. The claim has been discussed above as patentable over Stevens et al. As acknowledged in the Office Action (pages 9-10), Kuriyama et al. fails to teach or suggest at least the recited "halo implant region" of claim 15. Stevens et al. likewise fails at least in this regard. The references fail to teach or suggest the claimed subject matter. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 15 and 17 be withdrawn.

Claim 32 defines an imager device, as discussed above. The claim has been discussed above as patentable over Kuriyama et al. As acknowledged in the Office

Action (pages 9-10), Kuriyama et al. fails to teach or suggest the recited "halo implant" of claim 32. As discussed above in relation to other claims, Stevens et al. also fails in this regard. The references fail to teach or suggest the claimed subject matter. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 32 and 36 be withdrawn.

Claims 47 and 49 depend from independent claim 46, which has been discussed above as being patentable over Stevens et al. As acknowledged in the Office Action (pages 9-10), Kuriyama et al. fails to teach or suggest the recited "halo implant region" of claim 46. Stevens et al. also fails in this regard. The references fail to teach or suggest the claimed subject matter. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 47 and 49 be withdrawn.

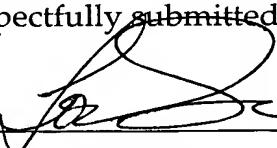
Claim 50 defines an integrated circuit comprising a transistor in electrical contact with a photodiode, and is patentable over Kuriyama et al., as discussed above. As acknowledged in the Office Action (pages 9-10), Kuriyama et al. fails to teach or suggest the recited "halo implant" of claim 32. As discussed above in relation to other claims, Stevens et al. also fails in this regard. The references fail to teach or suggest the claimed subject matter. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claims 50 and 52 be withdrawn.

Claim 48 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Stevens et al. in view of Kuriyama et al. and also in view of Komuro. Applicant respectfully traverses this rejection. Claim 48 depends from claim 46, which has been discussed above as patentable over each of these references, whether taken individually or in combination. For the same reasoning, claim 48 is patentable as well. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of claim 48 be withdrawn.

Applicant believes all pending claims are in immediate condition for allowance and respectfully requests a Notice of Allowance for all pending claims (1-35, 37-52, and 85-93).

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